DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 3, 4, 6, 7, 9-11, 15, 37, 43 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ecer (USP 6,048,432 cited in IDS) in view of Deevi et al. (US Pub 2002/0085941 of record).

In regard to **independent claim 1**, Ecer teaches a method for making a micro-fluidic structure (such as internally cooled device or electrorheological fluid handling device - see column 1 lines 34-43), at least a portion of which is intermetallic, by a micro-lamination process, the method comprising: patterning at least one the patternable intermetallic lamina (figure 4 - lamina 21 through 29) to form a NON-CORRUGATED patterned intermetallic lamina, the patternable intermetallic lamina comprising titanium aluminide (see column 13 - example 3), wherein the patterning is mechanical cutting (conventional mill cutter - see column 9 lines 35-50) adding at least one bonding material (such as any one of lamina 22-28) to the registered stack to facilitate bonding between the intermetallic lamina (such as 21) and a second lamina (such as 29) adjacent the intermetallic lamina; stacking and registering the patterned intermetallic lamina with at least one lamina other than the bonding lamina selected from patterned lamina, non-patterned lamina and combinations thereof, thereby forming

a registered stack (figure 6); and processing the registered stack to make a micro-fluidic structure comprising an intermetallic (consolidated part 10, 20 - figures 2 and 3).

Ecer teaches the lamina is made by compaction of metal powder (column 8 lines 41-50) but does not specifically disclose roll compaction. However, Deevi et al. teach a method of making intermetallic lamina and the ability to use roll compaction to form highly dense titanium aluminude sheets (paragraph [0022]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use roll compaction of metal powders to form the lamina in the process of Ecer as such create high density lamina/sheets as taught by Deevi et al. As this is the same as the claimed process the lamina formed are reasonable assumed to be ductile and patternable.

In regard to **claims 3, 4, 6 and 7**, these claims further define the iron aluminide or nickel aluminide. However, as titanium aluminide is still an option for these dependent claims, defining a specific nickel or iron aluminide does not define over the reference as it teaches titanium aluminide. In any event as previously applied Deevi et al. teach the ability to interchangeably use these materials for intermetallic structures (paragraphs [0026-0027]) to obtain the desired properties of the structure (paragraph [0052]).

In regard to **claim 9**, Ecer teaches a Ti/Al ratio (52/48) deemed to be close enough to TiAl (i.e. 50/50) that a person of ordinary skill in the art would expect them to have the same properties (column 13 lines 35).

In regard to **claim 10**, Deevi et al. teach the ability to interchangeably use TiAl and Ti_3Al intermetallic compounds (paragraph [0028]).

In regard to **claim 11**, Ecer teaches the bonding material (one of the intermediate lamina 22-28) is positioned between the first intermetallic lamina (such as 21) and a second intermetallic lamina (such as 29) (figure 4).

In regard to **claim 15**, Ecer teaches the method comprising procuring a lamina blank (green lamina - column 8 lines 42) or patterned lamina (see column 9 lines 35-50).

In regard to **claim 27**, Ecer teaches that electrorheological or cooling fluid may be incorporated into the structure (column 1 lines 34-43), both of which act as a catalyst for their desired operations.

In regard to **claim 37**, Ecer teaches the use of posts (alignments rods 79) for connecting the lamina (figure 8 - column 9 line 67).

In regard to **claims 43 and 45**, as noted above the multiple laminas 21-29 include TiAl.

3. Claims 12, 13, 16-20, 23-26, 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ecer and Deevi et al. as applied above and further in view of Norris et al. (USP 4,869,421 of record).

Ecer and Deevi et al. teach the method as applied above. **Claim 12** differs in calling for the bonding material to be pure nickel. However, Norris et al. teach a similar method of joining titanium aluminide sheets and the desirability to use a bonding

material (interlayer 14) which may be multilayer form with one or more thin layers of each constituent metal, such as a layer of pure nickel (column 3 lines 4-18).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a bonding layer of pure nickel in the method of Ecer as such is a known effective bonding layer for titanium aluminide sheets as taught by Norris et al. Please note this combination is not modifying the intermetallic lamina of Ecer to be corrugated. The person of ordinary skill in the art would have appreciated that the same technique and materials used for bonding a corrugated lamina would be suitable for the non-corrugated lamina of Ecer as well.

In regard to **claim 13**, Norris teach the bonding layer may be as thick as 0.0003 inches (column 3 line 26) or 7.62 microns.

In regard to **claims 16-20**, Norris et al. teach the desirability to use a second lamina (interlayer 14, note that there are two provided in figure 1 on each side at each interface) which may be multilayer form with one or more thin layers of each constituent metal, such as a layer of pure nickel and pure copper (i.e. different elements, column 3 lines 4-18). As there is two interlayers 14 provided and each has multiple layers this encompasses a bonding layer and three additional metal layers.

In regard to **claim 23**, Norris et al. teach the second interlayer 14 may powder, plasma or vapor deposited and acts as an adhesive (wetting during liquid phase) between core 12 and face sheet 16 (column 3 lines 19-28).

In regard to **claims 24-26,** Norris et al. teach the assembly is heated in a vacuum at sufficient time and temperature to cause an intermetallic to form by liquid-phase diffusion bonding (column 3 lines 53-68)

In regard to **claims 43 and 44**, Norris et al. teach as noted above the laminas include nickel foil 14, aluminum, titanium and intermetallics foils (face sheets 16 are intermetallic foils) thereof.

In regard to **claim 46**, as the method of the references places the foils in a predetermined order which is indistinguishable from that of claim 16 (there is no specific order claimed), the method of the combined reference is taken to reduce Kirkendall porosities.

Allowable Subject Matter

Claims 21 and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The closest prior art, Ecer, teaches making a micro-fluidic device from intermetallic lamina and Norris et al. teach that intermetallic lamina may be joined with multiple (such as 3) layers of pure metals such as nickel and copper. However the prior art as a whole fails to teach or fairly render obvious the method of claims 21 and 22 which require two of the bonding layers to be pure aluminum and the other to be either nickel or titanium

Response to Arguments

Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection. Specifically, the Ecer reference teaches making micro-fluidic devices out of patterned intermetallic lamina and is deemed to be the closest prior art to applicant's claimed and disclosed invention.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Inquiries

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas P. D'Aniello whose telephone number is (571)270-3635. The examiner can normally be reached on Monday through Thursday from 8am to 5pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on (571) 272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/N. P. D./
Examiner, Art Unit 1793

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